The Transmission of International Shocks to CIS Economies: A Global VAR Approach

Oleksandr Faryna

National Bank of Ukraine;
NU Kyiv-Mohyla Academy

Heli Simola

Bank of Finland Institute for
Economies in Transition (BOFIT)

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Introduction

- Commonwealth of Independent States (CIS) – a platform for coordinating regional economic and political developments
  - Heterogeneous emerging economies
  - Deeply interrelated
  - Closely connected to developed as well as emerging economies
  - Vulnerable to international shocks

- International shocks faced by individual country can be amplified through various spillover channels – multilateral perspective is crucial

Previous Literature

- CIS – sensitive to the US and euro area shocks
  - Feldkircher (2013) 1% shock to EA or US output increases CIS's GDP by 0.9% and 0.7%, respectively
- CIS – connected to emerging world, e.g., China
  - Feldkircher & Korhonen (2012) 1% shock to Chinese output transmits to about 0.2% rise in CIS's output
- Regional and Russian-specific shocks are significant for CIS
  - Alturki & al. (2009) 1% shock to Russian GDP is associated with a 0.35-0.45 % increase in CIS's GDP
  - Evidence on important spillovers for inflation and exchange rate developments, see Comunale & Simola (2016), Faryna (2016), Charemza et al. (2009), Dreger & Fidrmuc (2011)

Stylized Facts – output correlations

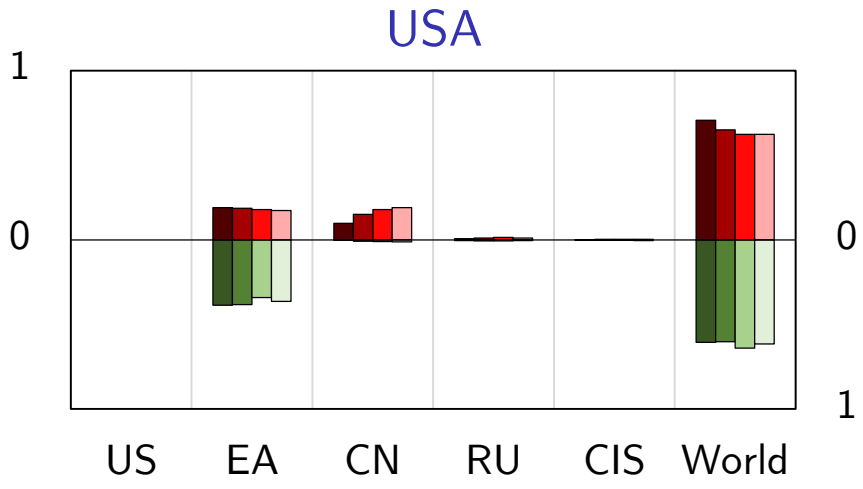
Pre-crisis 2001-2008	USA	EA	CHINA	RUSSIA	CIS
USA	1	0.36	0.28	0.52	0.14
EA	-	1	0.66	0.66	0.17
CHINA	-	-	1	0.85	0.19
RUSSIA	-	-	-	1	0.25
CIS	-	-	-	-	0.08*

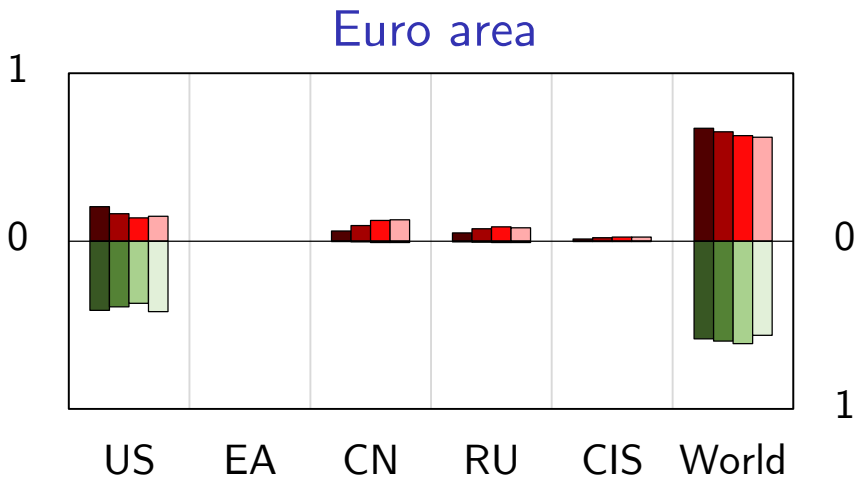
Post-crisis 2009-2016	USA	EA	CHINA	RUSSIA	CIS
USA	1	0.87	-0.31	0.70	0.30
EA	-	1	-0.20	0.61	0.25
CHINA	-	-	1	0.22	0.30
RUSSIA	-	-	-	1	0.58
CIS	-	-	-	-	0.41*

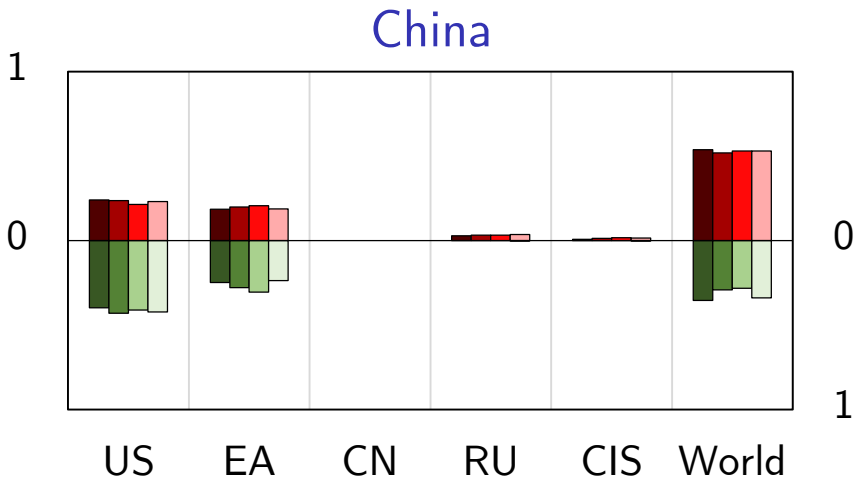
* shows average cross-country correlations within CIS economies

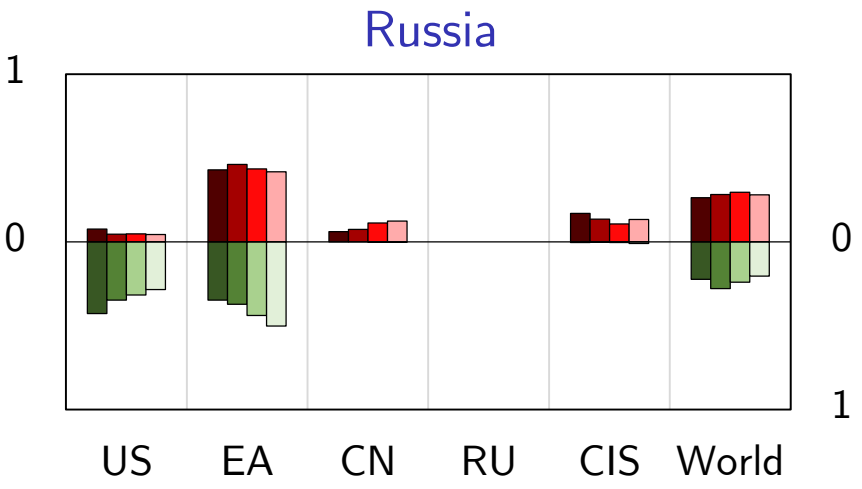
Source: World Bank Open Data - World Development Indicators

Stylized Facts – trade and financial linkages (1)





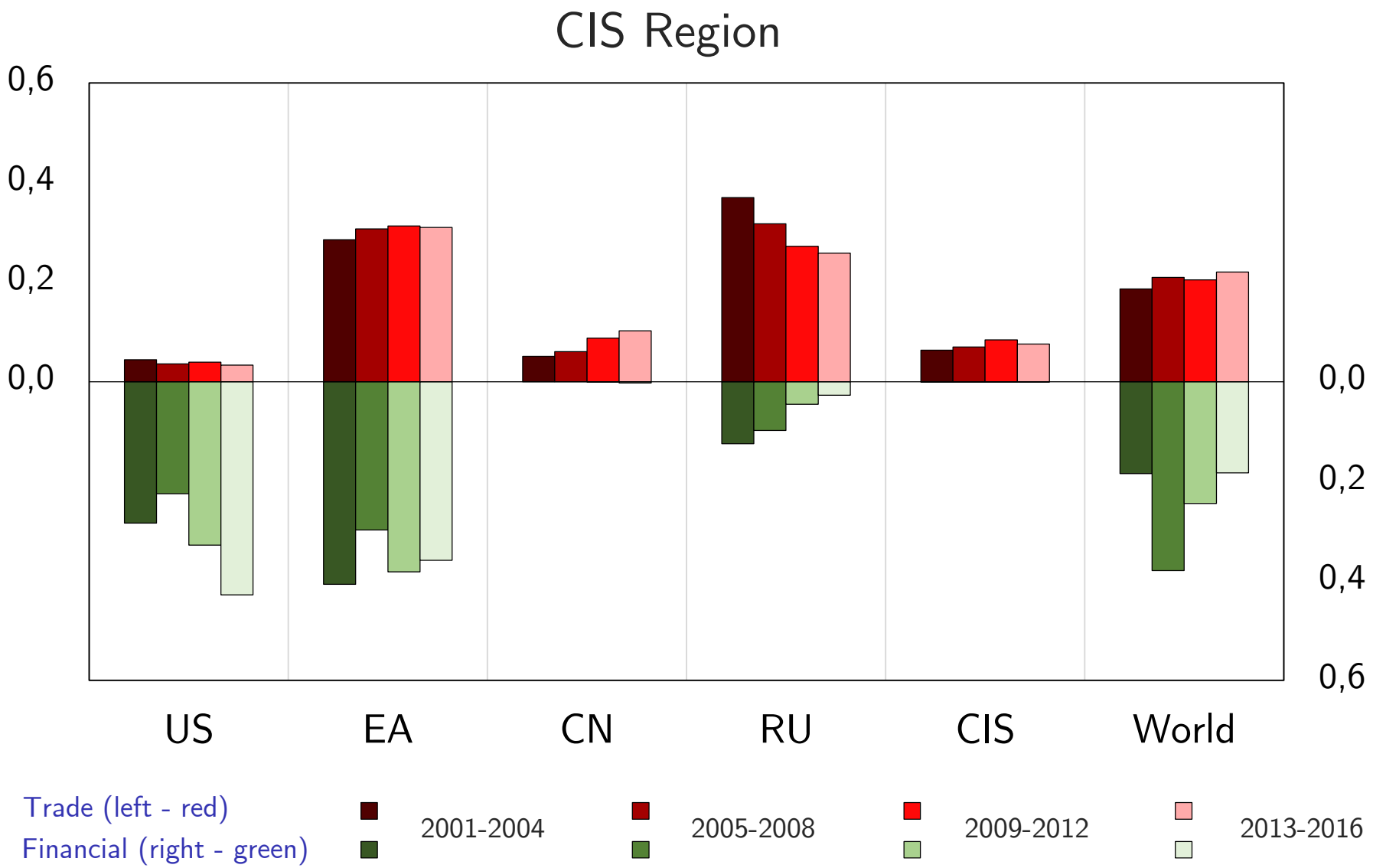




Trade (left - red)
Financial (right - green)

2001-2004 2005-2008 2009-2012 2013-2016

Stylized Facts – trade and financial linkages (2)



This paper:

- Employs Global Vector Autoregression (GVAR) model similar to Feldkircher (2013), Feldkircher & Korhonen (2012)
  - Accounts for cross-country interdependencies
- Examines the response of CIS to foreign and regional shocks
  - Output shocks in the US, EA, China, Russia, and CIS
  - Oil price shock
- Explores how those responses evolved over past decades as the international linkages – trade and financial relations – have experienced notable changes
  - In the spirit of Cesa-Bianchi et al. (2012)

Agenda

- Introduction
- Analytical Framework
  - GVAR model
  - The Data
  - Model Setup
- Results
  - Response to Output Shocks
  - Response to Oil Price Shock

Analytical Framework

- Modeling complex interdependent world through Vector Autoregressions (VAR):
- Panel VAR (PVAR)
  - Cross-country heterogeneity, dynamic and static interdependencies
  - Dimensionality and shock identification problems may arise
  - For small number of countries – potential omitted variable bias
  - If dynamic and static interdependencies are disabled – omitted higher order spillover channels
- Global VAR (GVAR)
  - VARs for individual countries combined through weight matrix
  - All features of PVAR
  - Solves dimensionality problem
  - Allows for accurate estimation of higher-order spillover channels

The GVAR Model

- GVAR – combination of individual VARX*
  - Presented in Pesaran, Schuermann & Weiner (2004)
  - Further developed in D´ees, di Mauro, Pesaran and Smith (2007)

$$\Phi_i(L, p_i)X_{it} = a_{i0} + \Lambda_i(L, q_i)X^*_{it} + \Psi_i(L, q_i)D_t + u_{it}$$

- X_{it} – domestic variables
- X^*_{it} – foreign variables
- D_t – global variables
- $u_{it} \sim iid(0, \sum_{ii})$

- Cross-country data usually shares common stochastic trend
  - cointegration relationships in each individual model – VECMX*

The GVAR Model (2)

- Foreign variables – weighted domestic counterparts

$$X_{it}^{*} = \sum_{j=1}^{N} \omega_{ij} X_{it} \,,$$

  - ω_{ij} – country specific weights such that $\sum_{j=1}^{N} \omega_{ij} = 1$

- Dominant Unit Model for global variables

$$\Psi(L, q\,) D_t = a_0 + \Lambda\left(L, q^{\#}\right) X_t^{\#} + u_t^{d},$$

$$X_{it}^{\#} = \sum_{j=1}^{N} \omega_{j}^{\#} X_{it} \,,$$

The Data

- 30 economies (about 80% of world PPP-GDP):

Commonwealth of Independent States (CIS)				
Azerbaijan	Belarus	Georgia*	Kazakhstan	Ukraine*
Shock originating economies				
USA	Euro area (modeled as region)		China	Russia
Rest of the world				
Australia	Czech Republic	India	Mexico	Romania
Brazil	Denmark	Indonesia	New Zealand	Sweden
Bulgaria	Hungary	Japan	Norway	Turkey
Canada	Iceland	Korea	Poland	United Kingdom
Chile				

* Not official members of CIS

The Data (2)

- Time span: 2001q1 – 2016q4

Domestic variables - X_{it}	
Real output	$y_{i,t} = \ln(RGDP_t)$
Consumer inflation	$dp_{i,t} = \ln(CPI_t) - \ln(CPI_{t-1})$
Interest rate	$r_{i,t} = NIR_t$
Real exchange rate	$e_{i,t} = \ln(NFX_t/CPI_t)$
Foreign variables - X^*_{it}	
Foreign output (y^*)	$y^*_{it} = \sum_{j=1}^{N} \omega^T_{ij} y_{it}$ – *trade weights*
Foreign interest rate (r^*)	$r^*_{it} = \sum_{j=1}^{N} \omega^F_{ij} r_{it}$ – *financial weights*
Global variables - D_t	
Brent oil prices	$f_t = \ln(BO_t)$

Sources: IFS IMF, OECD, National sources

The Data (3)

- Trade-weight matrix – for foreign output
  - Time-varying (year-specific)
  - Annual bilateral flows of exports plus imports in USD
  - Source: IMF Direction of Trade Statistics (DOTS)

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- Trade-weight matrix – for foreign output
  - Time-varying (year-specific)
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- Financial-weight matrix – for foreign interest rate
  - Time-varying (4-year period average)
  - Stocks of cross-border holdings of equities and long- and short-term debt securities (assets plus liabilities)
  - Source: IMF Coordinated Portfolio Investment Survey (CPIS)

Model Setup

- Stationarity
  - 38 out of 209 series – I(0)
  - 183 out of 209 series – I(1)
- Lag length
  - $p = 1$ and $q = 1$ (degrees of freedom considerations)
- Cointegration
  - Trace statistics for rank selection (1 to 3 cointegration equations)
  - LR test for the type of deterministics (case II-IV)
- Weak exogeneity
  - 72 out of 87 variables (F-test at 5% significance level)
- No residual serial correlation
  - 87 out of 119 equations (F-test at 5% significance level)

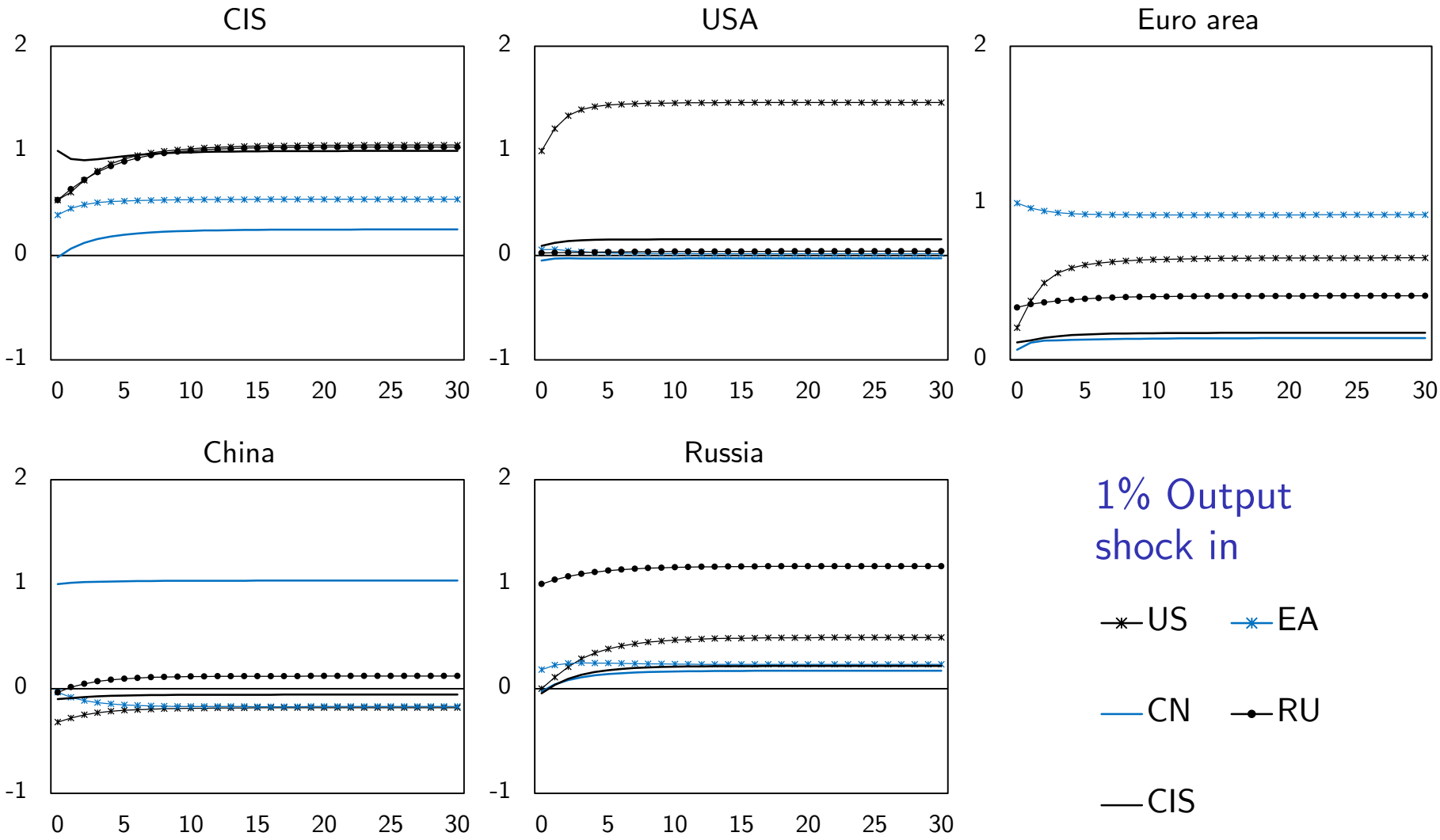
Results

- Generalized Impulse Response Function (GIRF)
  as in Pesaran and Shin (1998)
  - Insensitive to ordering of variables
  - Incorporating the week exogeneity assumption allows the identification of country-specific structural shocks

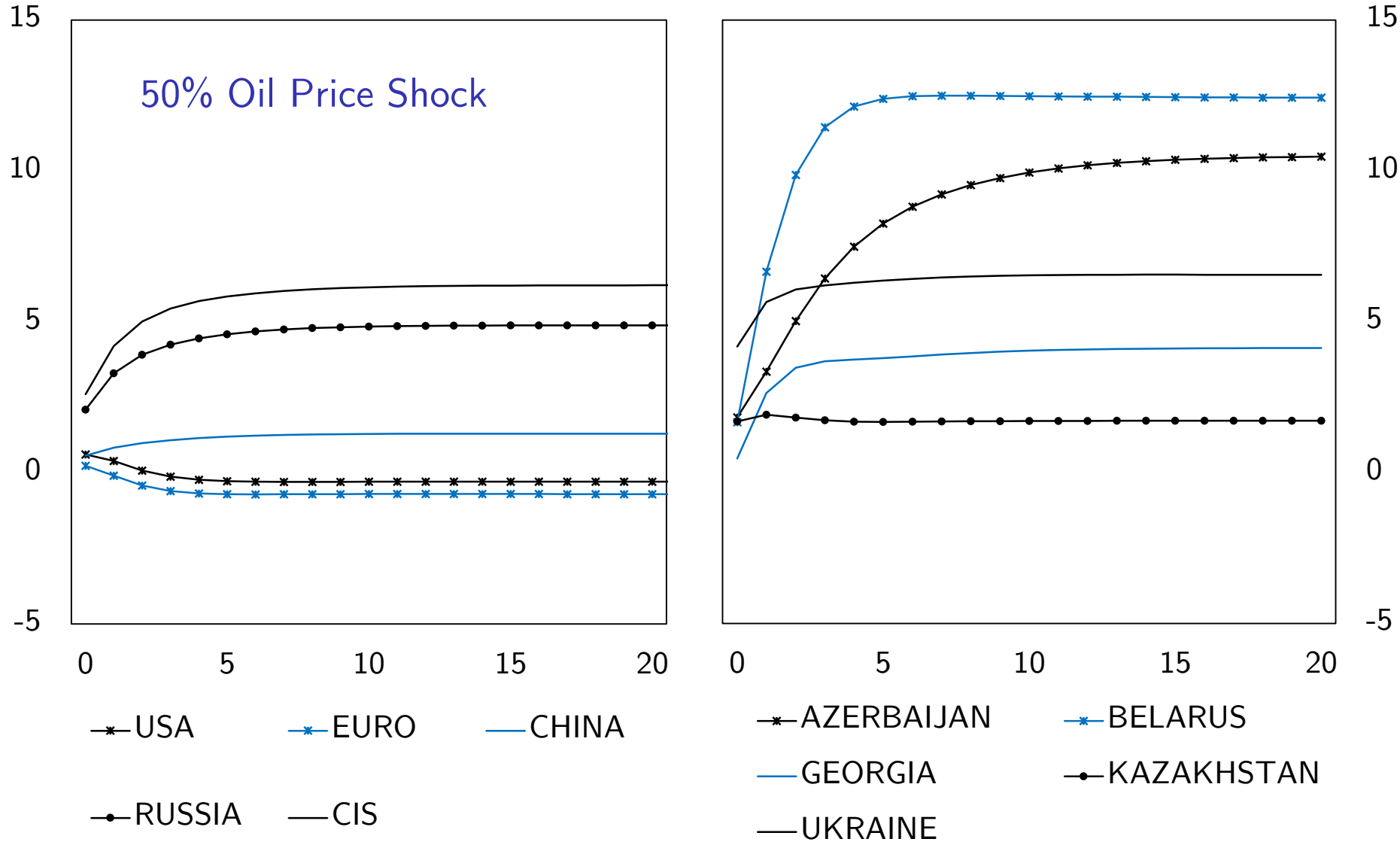
- Shocks scenarios:
  - 1% USA output
  - 1% euro area output
  - 1% Chinese output
  - 1% Russian output
  - 1% CIS output
  - 50% oil price

- 4 periods for solution matrices:
  - 2001-2004
  - 2005-2008
  - 2009-2012
  - 2013-2016

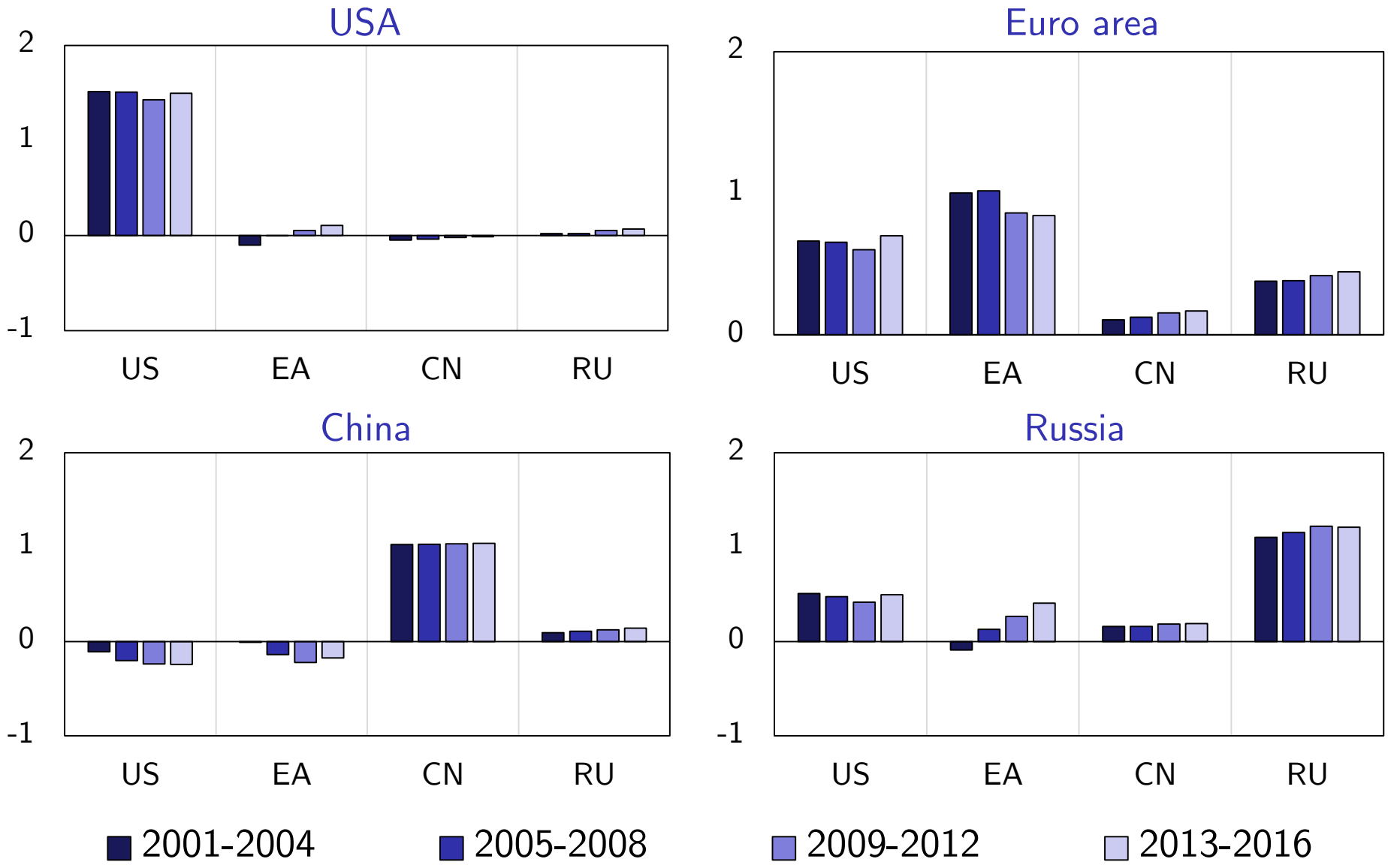
Output Shocks: average weights



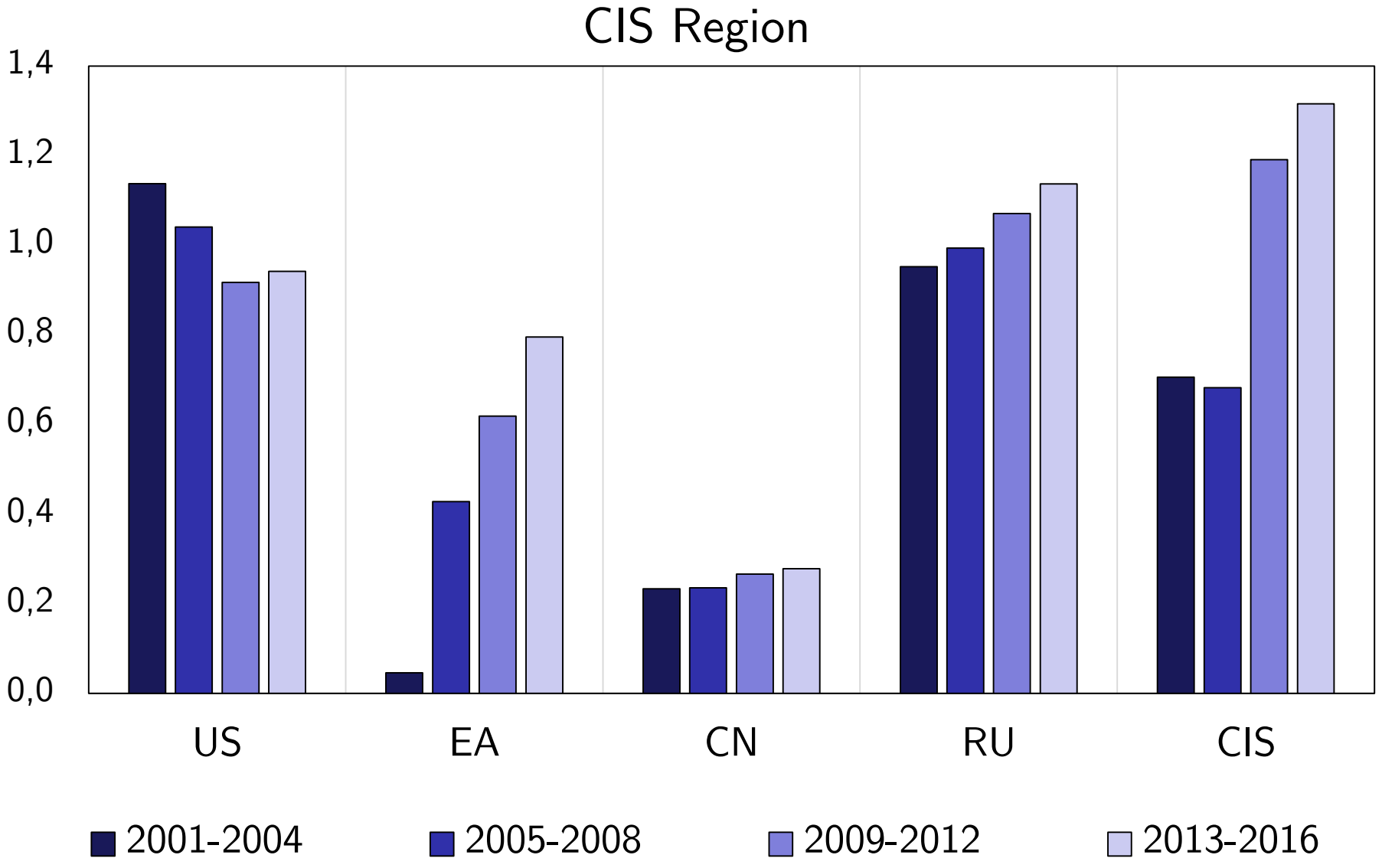
Oil Price Shock: average weights



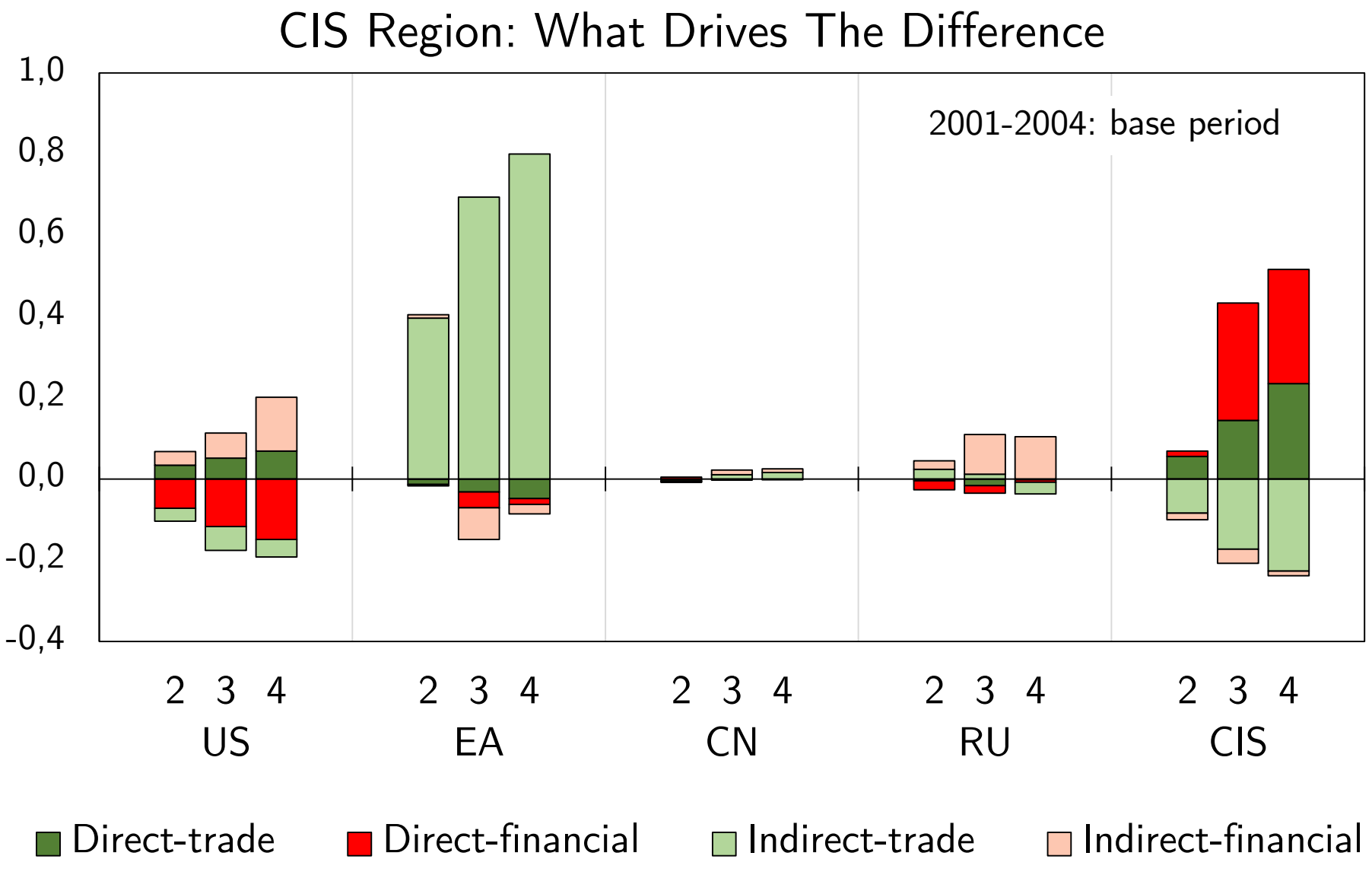
Output Shocks: time-varying weights



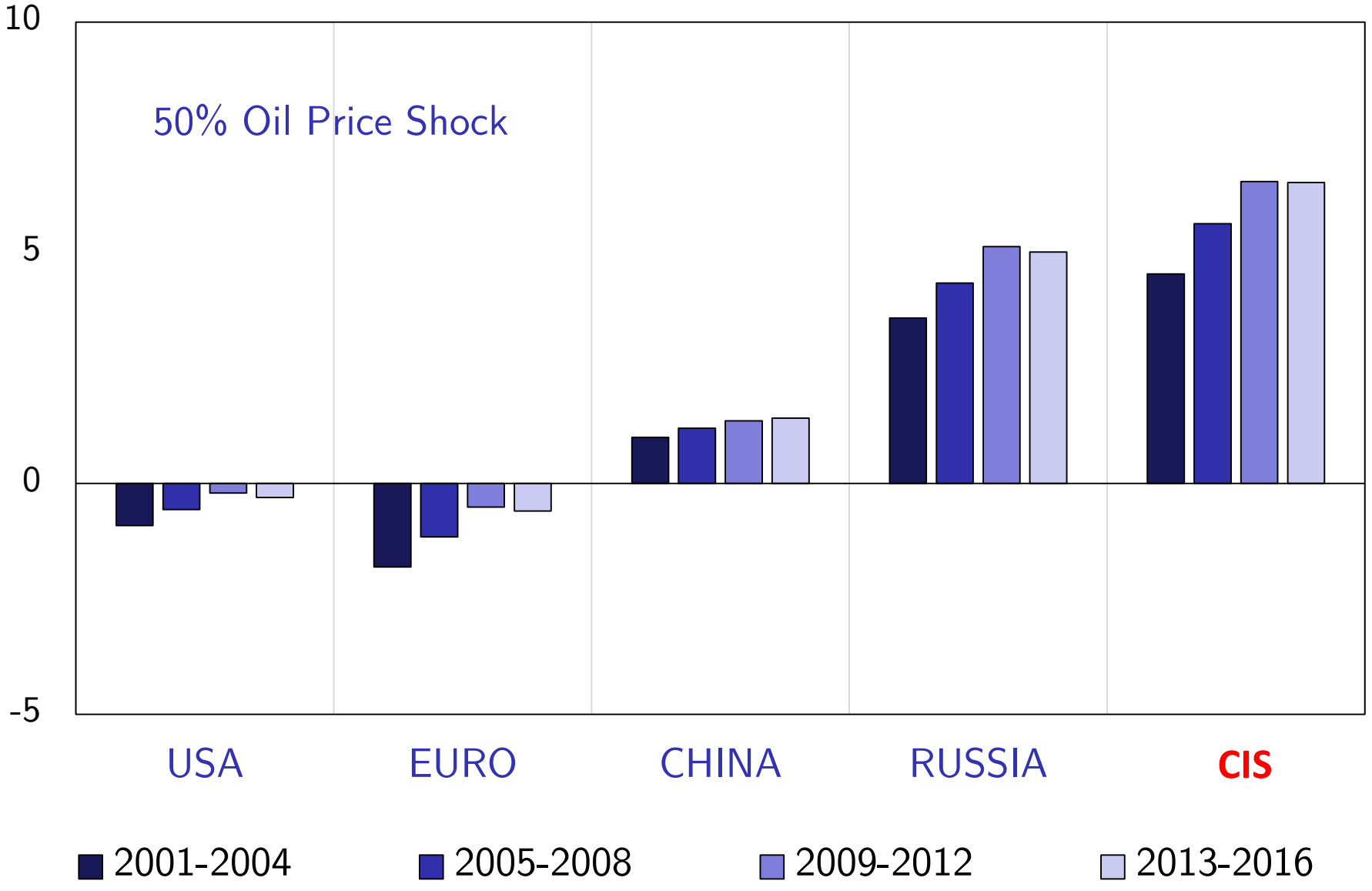
Output Shocks: time-varying weights



Output Shocks: decomposition



Oil Price Shock: time-varying weights



Key Messages (1)

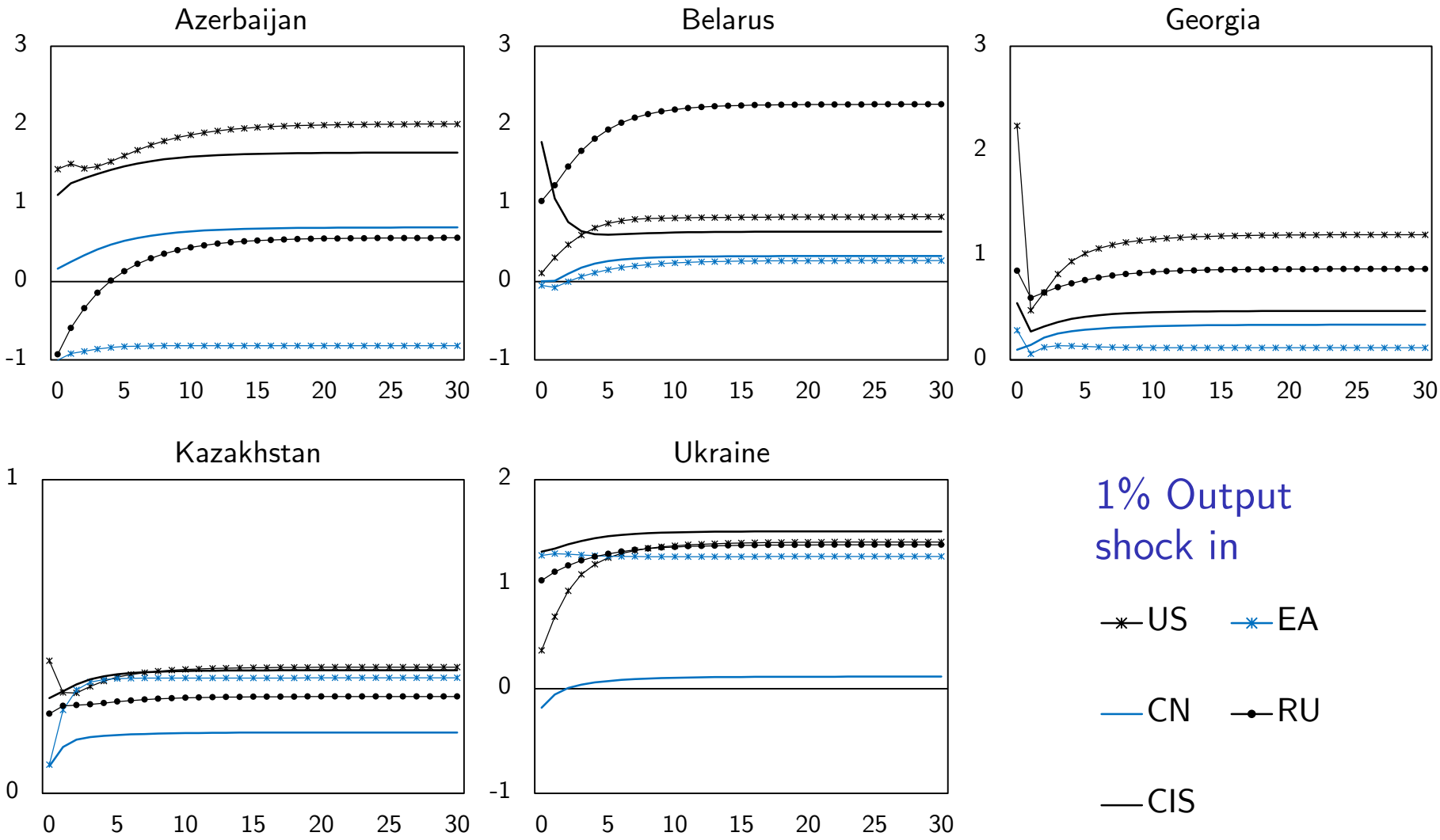
- CIS's response to foreign shocks has changed dramatically over past decades
- The US plays a dominant role in the world economy and for CIS in particular, but the effect is declining
- Russia remains being one of the major driver for CIS and the effect is increasing
- Moderate response to Chinese shocks despite the growing importance of China in the global arena

Key Messages (2)

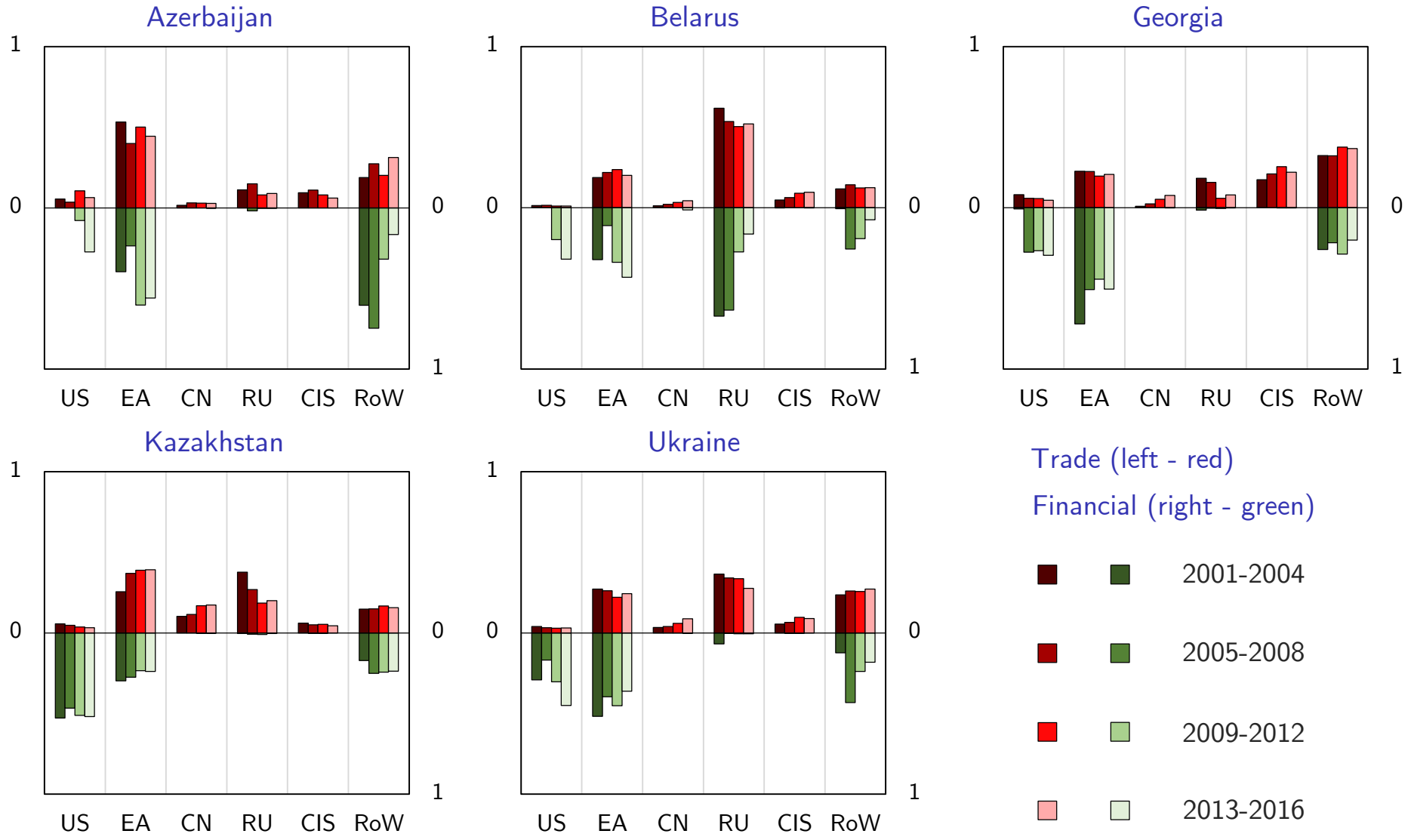
- The response to euro area shocks increased substantially due to changes in the trade composition of other countries
- The response to regional shocks after the GFC has almost doubled due to changes in CIS's trade and financial relations
- CIS are relatively more sensitive to the oil price shock and the effect is increasing

Appendix

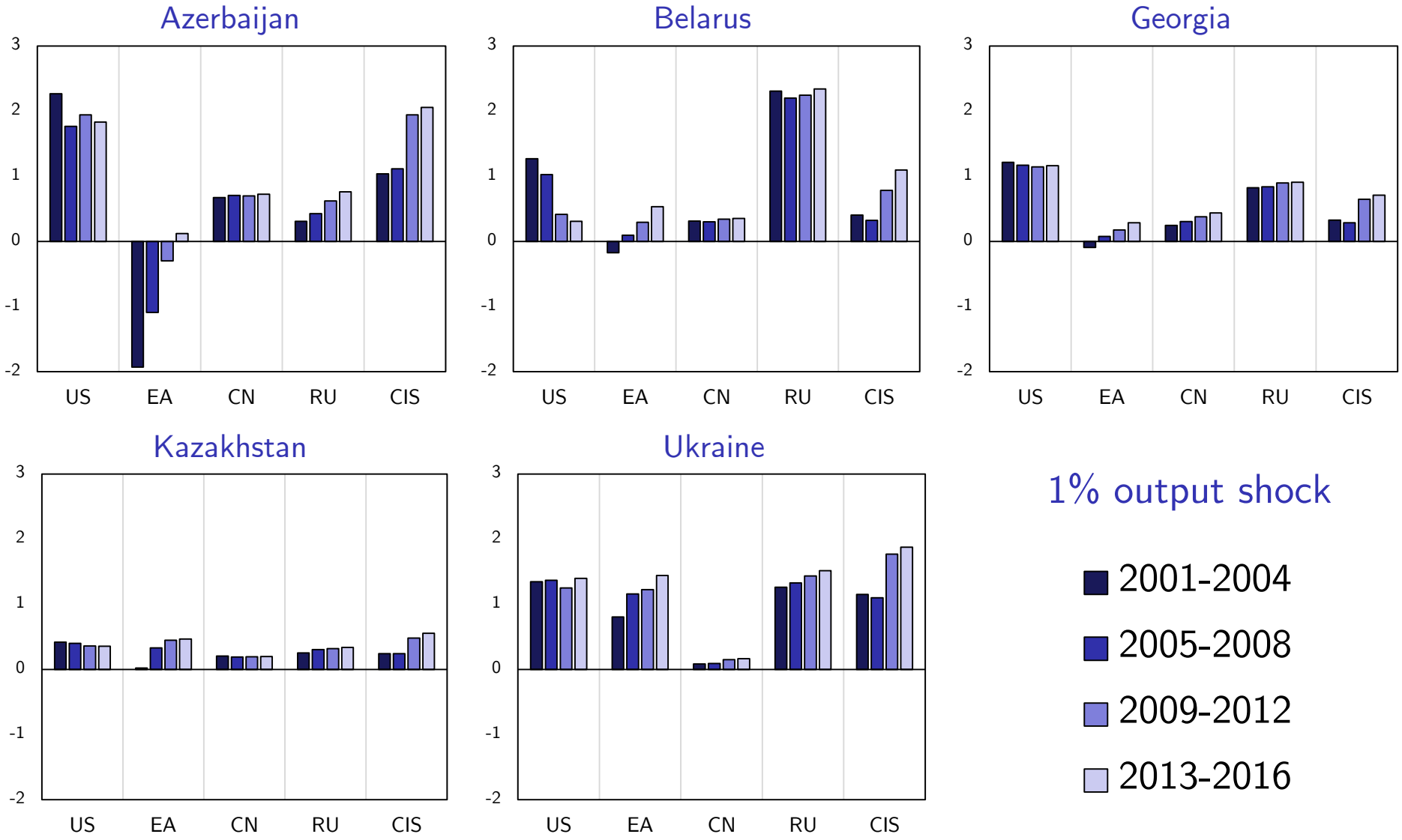
Output Shocks: average weights – CIS individual



Trade and financial linkages – CIS individual



Output Shocks – CIS individual



Oil Price Shock: CIS individual